

Rowland's own researches with his grating are summed up in his map of the solar spectrum and his table of the wave-lengths of the elements, published in 1893 (*Phil. Mag.*, July, 1893, reprinted from *Astronomy- and Astro-Physics*.)

Of late years he gave much time and attention to a system of multiple telegraphy; this was shown working at the Paris Exhibition last year.

Enough has been written, perhaps, to indicate the debt physical science owes to Rowland; it is said he never received any regular instruction in physics; he was an engineer, and to this, in great measure, his success is due. The accuracy of his work on the ohm depends on the care he took to construct his induction coils so that their dimensions could be accurately measured; he dealt with the determination of the mechanical equivalent as an engineering problem; he employed a large mass of water and used steam power to rotate his paddle at a speed sufficient to make the resulting rise in temperature one that could be measured with accuracy.

The theory of the concave grating was his, but its success was due to the fact that Rowland had made an almost perfect screw; the method he employed in this is given in his article, "Screw," in the "Encyclopædia Britannica."

He lived for his work, but in his earlier days he was passionately fond of riding. Some years after the publication of the paper on the mechanical equivalent he was awarded a prize for it by one of the Italian Academies; about the same time he won a steeple-chase, riding his own horse; he hardly knew which event gave him the greater pleasure. Another time, passing through England on his way home from the Continent, he had three days to spare. One of these was passed at Cambridge discussing electrical measurements, the other two were spent in a hurried visit to Exmoor to get a run with the staghounds. Twenty years ago he was a frequent visitor to England, and attended several of the meetings of the British Association; recently his visits were much less frequent. His friends here were aware that he was not well; some few weeks ago it was known that he had had a serious illness, but the news then was that he was better and on the road to recovery; however, an operation proved necessary, and he never recovered from its effects.

Thus within the last few months physical science is the poorer by the deaths of two of the most brilliant of the followers of Maxwell—Fitzgerald and Rowland; two who were foremost among those who have given to the theory of Faraday and Maxwell the right to claim the position of the theory of the electro-magnetic field.

R. T. G.

PROF. FRANÇOIS MARIE RAOULT.

FRANÇOIS RAOULT, professor of chemistry at Grenoble, died there on April 1 after a short illness. In him France has lost one of her most distinguished men of science, whose discoveries have supplied material for theoretical considerations which, within the past fifteen years, have had a most profound influence on chemistry and physics.

Raoult was born on May 10, 1830, at Fournes (Nord). His father, an officer in the local customs' service of Villers Cotterêts (Aisne), sent the boy to school at Laon, with the intention of his afterwards entering Government service. But Raoult's tastes lay in a different direction; and with the full consent of his father he finished his school career at Paris, and entered the scholastic profession. He began his teaching career at the age of 23 in the Lycée at Reims, and was shortly afterwards transferred to the Collège of Saint Dié; while there he

graduated as B. ès Lettres, and B. ès Sciences, passed his "Licencié" examination, and was appointed "Agrége" of special secondary instruction. On presenting a thesis on "The Electromotive Forces of Voltaic Cells" he gained the title of "Docteur ès Sciences Physiques," and four years later, in 1870, he obtained the chair of chemistry at Grenoble, where he passed the rest of his life in constant labour in teaching and research during a period of 31 years. In 1889 he was elected "doyen," or dean of the faculty, and was re-elected to this important office four times. He occupied himself largely during the last dozen years in the reorganisation of the Faculty of Science, leading to the creation of a local university at Grenoble in 1896.

The author of this notice was once informed by Raoult that he independently discovered Faraday's and Ohm's laws; he had begun to experiment on the passage of electricity through solutions before he had acquired any real knowledge of what had already been achieved. On mentioning the fact to his scientific friends at Paris he learned, to his great disappointment, that his discoveries had been anticipated; but he took comfort in the thought that if he were able to make such discoveries, of which the importance is universally recognised, he must also be able to advance science in other directions. His first scientific work, published as his thesis for the doctorate, has already been mentioned; it was published in 1863, and until 1870 he devoted himself to a study of the chemical effects of the electric current, trying to distinguish between the heat evolved by chemical reactions and that due to the electric current in the voltaic cell. From 1870 to 1886 his attention was given to subjects of a more purely chemical nature, such as the extent of inversion of cane sugar under the influence of solar radiation; the absorption of ammonia by saline solutions; the presence of copper and zinc in the animal organism; the carbonates of calcium, strontium and barium; and the influence of carbonic anhydride on respiration. His work on the absorption of ammonia led him to consider the freezing-points of the saline solutions of that gas (1878); and from that date onwards he busied himself with the freezing- and boiling-points of solutions in water and in other solvents of salts and organic compounds, publishing his results in no less than 57 memoirs in various scientific journals. His last publication, "La cryoscopie," was published in the present year (*Collection Scientia*, Carré et Naud).

Most of Raoult's apparatus was constructed with his own hands; he was rather given to accurate experimentation than to the evolution of theories. The vast mass of evidence which he accumulated relative to the lowering of the freezing-points and of the vapour-pressures of solvents by the presence of dissolved substances made it possible for van 't Hoff to draw the important deductions relative to the connection of these phenomena with osmotic pressure and with the ionic theory of Arrhenius, which will ever shed lustre on his name. And to the practical chemist Raoult's work furnished a means of determining the molecular weights of non-volatile substances—methods familiar to every student of chemistry.

His labours met with ample, though tardy, recognition. In 1889 he was awarded the *Prix Lecaze*, of 10,000 francs; and in the same year he was made *correspondant de l'Institut de France*. In 1895 he received the biennial prize of the Institute; in 1892 he was the Davy medallist of the Royal Society, and in 1898 he was elected a Foreign Fellow of the Chemical Society of London. He was chosen *Chevalier de la Légion d'Honneur* in 1890, raised to *Officier* in 1895, and last year obtained the much-coveted title of *Commandeur*. He was a member of many foreign academies and scientific societies.

Though modest and retiring, Raoult's devotion to his work, dignity of character and sweetness of temper gained him many friends. He was not an ambitious

man, but was content to work on, happy if his discoveries contributed to the advancement of science. It is to the labours of such men that the progress of the world, both scientific and industrial, is due; for the methods which he introduced have led, not merely to a knowledge of the structure of many compounds which would otherwise have remained unknown, but have also had a profound influence on chemical theory, and have led to many discoveries of the utmost practical utility. He lived a happy and contented life, and even in his death his desire was satisfied; for in his discourse at the grave of his predecessor in the office of dean of the Faculty of Science at Grenoble, Lory, he gave utterance to the words:—"Puisque la mort est inévitable, ne vaut-il pas mieux tomber ainsi tout entier, que de sentir la diminution lente et progressive de ses forces et de son intelligence?" Raoult died, after a few days' illness, without pain.

W. R.

DR. A. HIRSCH.

INFORMATION has reached us from the president of the Council of State for the Republic and Canton of Neuchâtel of the death, at Neuchâtel on April 18, of Dr. Adolph Hirsch, aged 71, the director of the observatory at Neuchâtel since its foundation in 1859. Dr. Hirsch was also secretary to the International Committee of Weights and Measures, established at Paris under the Metric Convention of 1875.

Dr. Hirsch contributed largely to our knowledge astronomy and meteorology, his earlier papers on the former subject having appeared in Berlin and Vienna, and his later papers, particularly with reference to the establishment and position of the new observatory in the Neuchâtel *Bulletin*. ("Établissement de l'Observatoire à Neuchâtel," *Bul.* v. 1859-1861; "Recherches sur des Pendules Astronomiques," *Bul.* v. 1859-1861; "Découverte de deux nouvelles petites planètes," *Bul.* v. 1859-1861; "Rélation des phénomènes météorologique avec la marche, des instruments magnétiques," *Bul.* vi.; "Influence des taches du Soleil sur la température de la Terre," 1877; Sur le passage de Venus," 1883, etc.). In more recent years Dr. Hirsch has been closely identified with the introduction of the metric system of weights and measures as an international system. He was a member of the original Commission International du Metre of 1872, of which the present eminent director of the Imperial Observatory, Dr. W. Foerster, and Dr. Von Lang, of the University of Vienna, were also members. On the establishment of the new International Committee of Weights and Measures in 1875, Dr. Hirsch became its secretary, a position which he filled until his death. A master in metrological science and a prince of secretaries, his loss will be deeply deplored by all whose opportunity it was to seek his valuable advice and to be guided by his profound experience.

NOTES.

THE gentlemen's soiree of the Royal Society will be held next Wednesday, May 8. The ladies' conversazione will not be held this year, in consequence of the death of Queen Victoria.

THE position of affairs at Coopers Hill College is most unsatisfactory. We understand that the Members of Parliament who are interested in the higher education of the country had obtained permission to move the adjournment of the House in order to discuss the latest report on the management of this institution laid before Parliament by Lord George Hamilton, but that some M.P., presumably at the instigation of the India Office, which shuns inquiry, has "blocked" this permission. This proceeding, which, unfortunately, the rules of the House allows,

is but another instance of the diminishing power of the private member and the increasing domination of the Government. Lord George Hamilton stated last week that he had asked the Universities of Oxford, Cambridge and London to nominate representatives on the Board of Visitors. When reconstituted the Board is to appoint a committee to hold an inquiry into the whole working of the College. This committee can do nothing to lessen the gravity of the recent action of the Board of Visitors in the matter of the dismissed teachers. They may, however, be able to secure some sort of recognition of the professoriate in the management and policy of the College, and some diminution of the absolute power of one individual, which has recently wrought such harm both at Coopers Hill in England and at the Leland Stanford University in America.

THE reality of the connection between rats and plague is prominently brought into notice by the issue of a circular by the Local Government Board, instructing the sanitary authorities of seaports to take precautions against the entrance of plague-infected rats into this country. On the arrival in port of a vessel upon which, during the voyage, plague or sickness suspected to be plague has occurred, measures are to be taken to secure the destruction of the rats on board the vessel, and to prevent them from reaching the shore. In the case of vessels that have come from places infected with plague, strict inquiry is to be made on their arrival in port as to mortality or sickness among rats during the voyage. In the event of rats on board any ship being found to be infected with plague, all parts of the vessel frequented by those animals are, so far as possible, to be disinfected. The authorities of seaport towns invaded by plague are advised to endeavour to secure the destruction of the rats in the town, not least those inhabiting the docks and quayside warehouses. In connection with these instructions, it is worth while to bear in mind that plague is not usually transmitted by the bite of a diseased rat, but by fleas living on such rats. Experiments have shown that a healthy rat will quickly contract plague if caged with a diseased rat infested with fleas, but will not do so if the diseased rat is free from fleas. Perfectly healthy rats harbour very few fleas and are very expert in removing them, but these insects are abundant on sick rats. After death, as the body becomes cold, the fleas leave the rat, and if they reach another rat or human being they may inoculate their new host with the bacilli of plague.

PROF. BROUARDEL, Dean of the Paris Faculty of Medicine, has announced that at the end of his present term of office—namely, in February 1902—he will not accept re-appointment.

THE Rev. James Chalmers, who is reported to have been murdered in New Guinea, with the Rev. O. F. Tomkins and twelve students, was known to many anthropologists, and made some noteworthy contributions to our knowledge of the natives of New Guinea, where he passed twenty-three years of his life. His death has often been reported before now, and there is always a possibility that rumours from New Guinea will prove to be untrue; but we fear that in this case the news will be confirmed.

THE founders' medal of the Royal Geographical Society has been awarded to the Duke of the Abruzzi for his expedition to Mount St. Elias and for Arctic exploration. Dr. A. Donaldson Smith has been awarded the patrons' medal for his African expeditions and the important scientific observations made in connection with them. Awards have also been made to Mr. Louis Bernacchi and Captain Colbech for their aid in the *Southern Cross* Antarctic expedition, and to Captain Cagni for his journey to 86° 33' N., on the Duke of the Abruzzi's expedition.